

Product Specification

QSFP 40G LR4 10km LC Transceiver



1. Features

- 4 CWDM lanes MUX/DEMUX design
- Up to 11.2Gbps data rate per wavelength
- QSFP+ MSA compliant
- Up to 10km transmission
- Operating case temperature: 0-70°C
- Maximum 3.5W operation power
- RoHS compliant

2. Applications

- 40G Ethernet
- Infiniband interconnects
- 40G Telecom connections

3. General Description

This product is a transceiver module designed for 10km optical communication applications. It is in compliance with the 40GBASE-LR4 of the IEEE 802.3ba standard. The module converts 4 inputs channels of 10Gb/s electrical data to 4 CWDM optical signals, and multiplexes them into a single channel for 40Gb/s optical transmission. Reversely, on the receiver side, the module optically de-multiplexes a 40Gb/s input into 4 CWDM channels signals, and converts them to 4 channel output electrical data. The central wavelengths of the 4 CWDM channels are 1271, 1291, 1311 and 1331 nm as members of the CWDM wavelength grid as defined in ITU-T G694.2. It contains a duplex LC connector for the optical interface and a 38-pin connector for the electrical interface. Single-mode fiber (SMF) is applied in this module. The product is designed with form factor, optical/electrical connection and digital diagnostic interface according to the QSFP Multi-Source Agreement (MSA). It meets the external operating conditions including temperature, humidity and EMI interference.

4. Functional Description

This product converts the 4-channel 10Gb/s electrical input data into CWDM optical signals (light), by a 4-wavelength Distributed Feedback Laser (DFB) array. The 4 wavelengths are multiplexed into a single 40Gb/s data, propagating out of the transmitter module via the SMF. The receiver module accepts the 40Gb/s optical signals input, and de-multiplexes it into 4 CWDM 10Gb/s channels. Each wavelength light is collected by a discrete photo diode, and then outputted as electric data after amplified by a TIA. Figure 1 shows the functional block diagram of this product.

A single +3.3V power supply is required to power up this product. Both power supply pins VccTx and VccRx are internally connected and should be applied concurrently. As per MSA specifications the module offers 7 low speed hardware control pins (including the 2-wire serial interface): ModSelL, SCL, SDA, ResetL, LPMode, ModPrsL and IntL.

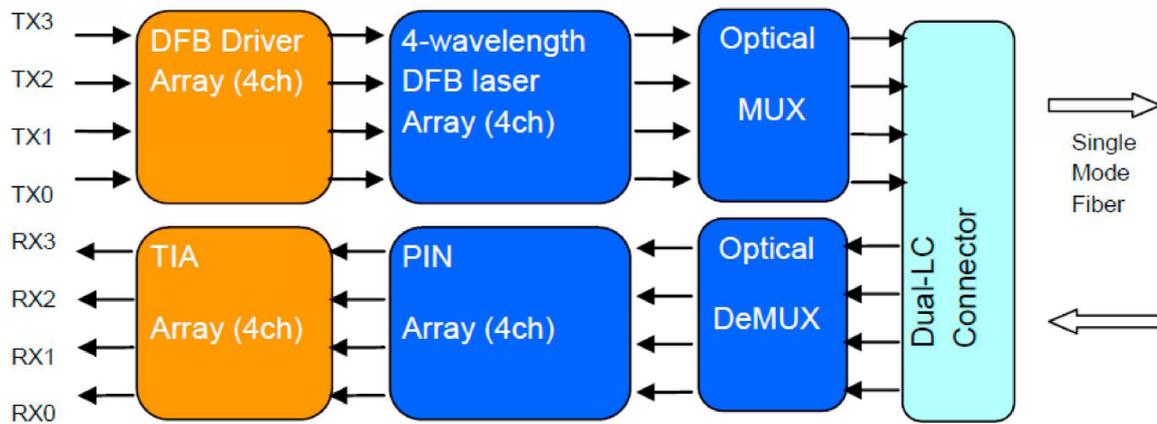
Module Select (ModSelL) is an input pin. When held low by the host, this product responds to 2-wire serial communication commands. The ModSelL allows the use of this product on a single 2-wire interface bus - individual ModSelL lines must be used.

Serial Clock (SCL) and Serial Data (SDA) are required for the 2-wire serial bus communication interface and enable the host to access the QSFP memory map. The ResetL pin enables a complete reset, returning the settings to their default state, when a low level on the ResetL pin is held for longer than the minimum pulse length. During the execution of a reset the host shall disregard all status bits until it indicates a completion of the reset interrupt. The product indicates this by posting an IntL (Interrupt) signal with the DataNotReady bit negated in the memory map. Note that on power up (including hot insertion) the module should post this completion of reset interrupt without requiring a reset.

Low Power Mode (LPMode) pin is used to set the maximum power consumption for the product in order to protect hosts that are not capable of cooling higher power modules, should such modules be accidentally inserted. Module Present (ModPrsL) is a signal local to the host board which, in the absence of a product, is normally pulled up to the host Vcc. When the product is inserted into the connector, it completes the path to ground through a resistor on the host board and asserts the signal. ModPrsL then indicates its present by setting ModPrsL to a «Low» state.

Interrupt (IntL) is an output pin. When «Low», it indicates a possible operational fault or a status critical to the host system. The host identifies the source of the interrupt using the 2-wire serial interface. The IntL pin is an open collector output and must be pulled to the Host Vcc voltage on the Host board.

5. Transceiver Block Diagram



6. Absolute Maximum Ratings

Rating	Symbol	Min.	Max.	Units
Storage Temperature	Tst	-20	85	°C
Relative Humidity (non-condensation)	RH	0	85	%
Operating Case Temperature	Topc	0	70	°C
Operating Range		0.002	10	km
Supply Voltage	VCC	-0.5	3.6	V

7. Optical Characteristics

Parameter	Symbol	Min.	Typical	Max.	Unit
Wavelength Assignment	L0	1264.5	1271	1277.5	nm
	L1	1284.5	1291	1297.5	nm
	L2	1304.5	1311	1317.5	nm
	L3	1324.5	1331	1337.5	nm
Transmitter					
Side-mode Suppression Ratio	SMSR	30	-	-	dB
Total Average Launch Power	PT	-	-	8.3	dBm
Average Launch Power, each Lane		-7	-	2.3	dBm
Optical Modulation Amplitude, each Lane	OMA	-4	-	3.5	dBm

Parameter	Symbol	Min.	Typical	Max.	Unit
Difference in Launch Power between any two Lanes (OMA)		-	-	6.5	dB
Launch Power in OMA minus Transmitter and Dispersion Penalty (TDP), each Lane		-4.8			dBm
TDP, each Lane	TDP			2.3	dB
Extinction Ratio	ER	3.5	-	-	dB
Relative Intensity Noise	Rin	-	-	-128	dB/Hz ^[3]
Optical Return Loss Tolerance		-	-	20	dB
Transmitter Reflectance	RT			-12	dB
Transmitter Eye Mask					
Definition {X1, X2, X3, Y1, Y2, Y3}		{0.25, 0.4, 0.45, 0.25, 0.28, 0.4}			
Average Launch Power OFF Transmitter, each Lane	Poff			-30	dB
Receiver					
Damage Threshold	THd	3.3			dBm ^[1]
Average Power at Receiver Input, each Lane		-13.7		2.3	dBm
Receiver Reflectance	RR	-	-	-26	dB
Receiver Power (OMA), each Lane		-	-	3.5	dBm
Receiver Sensitivity, each Lane	SR	-	-	-11.5	dBm
Stressed Receiver Sensitivity in OMA, each Lane		-	-	-9.9	dBm
Difference in Receive Power between any two Lanes (OMA)				7.5	dB
Receive Electrical 3 dB upper Cutoff Frequency, each Lane				12.3	GHz
Conditions of Stress Receiver Sensitivity Test:					
Vertical Eye Closure Penalty, each Lane			1.6		dB
Stressed Eye Jitter, each Lane			0.3		UI

Notes:

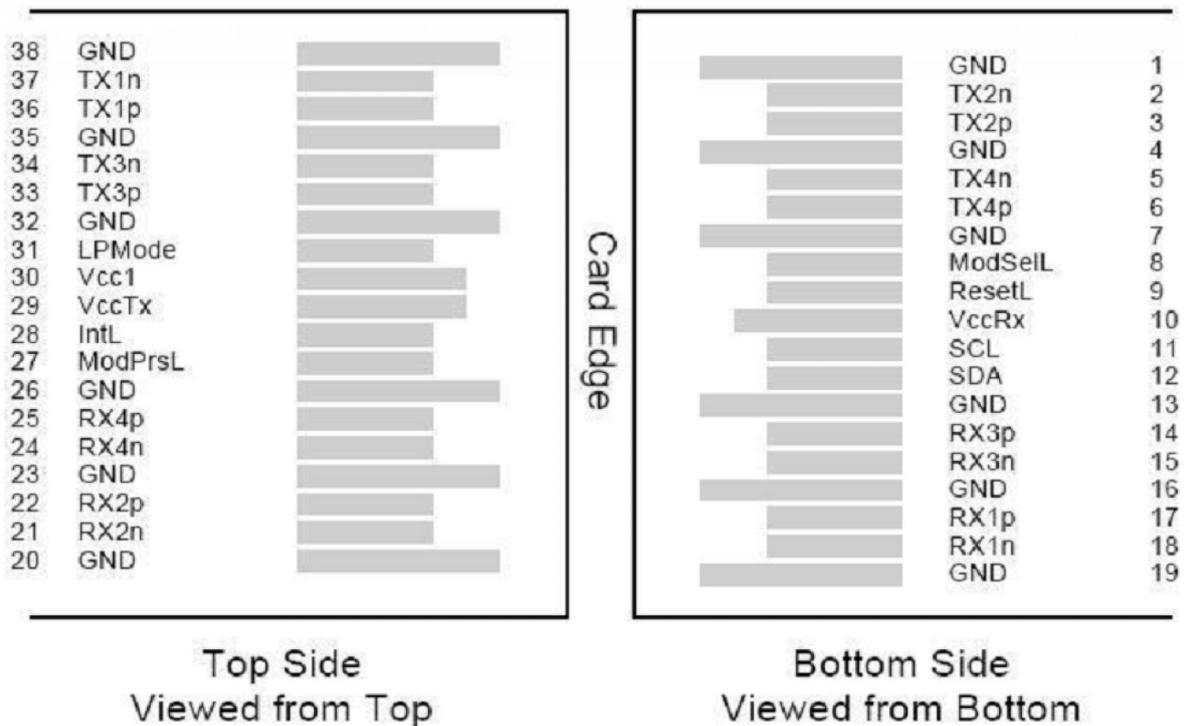
- [1] The receiver shall be able to tolerate, without damage, continuous exposure to a modulated optical input signal having this power level on one lane. The receiver does not have to operate correctly at this input power.
- [2] Vertical eye closure penalty and stressed eye jitter are test conditions for measuring stressed receiver sensitivity. They are not characteristics of the receiver.
- [3] 12dB reflection

8. Electrical Characteristics

The following electrical characteristics are defined over the Recommended Operating temperature and supply voltage unless otherwise specified.

Parameter	Symbol	Min.	Typical	Max.	Unit
Supply Voltage	V _{ccI} , V _{ccTx} , V _{ccRx}	-0.5	-	3.6	V
Data Rate, each Lane		-	10.3125	11.2	Gbps

Pin Description



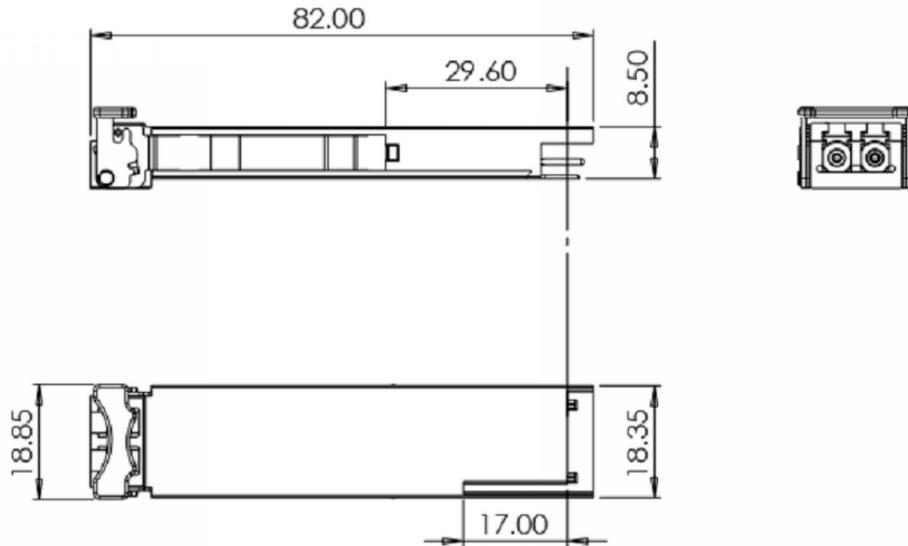
Pin	Logic	Symbol	Name/Description
1		GND	Ground ^[1]
2	CML-I	Tx2n	Transmitter Inverted Data Input
3	CML-I	Tx2p	Transmitter Non-Inverted Data output
4		GND	Ground ^[1]
5	CML-I	Tx4n	Transmitter Inverted Data Input
6	CML-I	Tx4p	Transmitter Non-Inverted Data output
7		GND	Ground ^[1]
8	LVTLL-I	ModSelL	Module Select
9	LVTLL-I	ResetL	Module Reset
10		VccRx	+ 3.3V Power Supply Receiver ^[2]
11	LVTLL-I/O	SCL	2-Wire Serial Interface Clock

Pin	Logic	Symbol	Name/Description
12	LVC MOS-I/O	SDA	2-Wire Serial Interface Data
13		GND	Ground
14	CML-O	Rx3p	Receiver Non-Inverted Data Output
15	CML-O	Rx3n	Receiver Inverted Data Output
16		GND	Ground ^[1]
17	CML-O	Rx1p	Receiver Non-Inverted Data Output
18	CML-O	Rx1n	Receiver Inverted Data Output
19		GND	Ground ^[1]
20		GND	Ground ^[1]
21	CML-O	Rx2n	Receiver Inverted Data Output
22	CML-O	Rx2p	Receiver Non-Inverted Data Output
23		GND	Ground ^[1]
24	CML-O	Rx4n	Receiver Inverted Data Output ^[1]
25	CML-O	Rx4p	Receiver Non-Inverted Data Output
26		GND	Ground ^[1]
27	LVTTL-O	ModPrsL	Module Present
28	LVTTL-O	IntL	Interrupt
29		VccTx	3.3 V Power Supply transmitter ^[2]
30		Vcc1	3.3 V Power Supply ^[2]
31	LVTTL-I	LPMODE	Low Power Mode
32		GND	Ground ^[1]
33	CML-I	Tx3p	Transmitter Non-Inverted Data Input
34	CML-I	Tx3n	Transmitter Inverted Data Output
35		GND	Ground ^[1]
36	CML-I	Tx1p	Transmitter Non-Inverted Data Input
37	CML-I	Tx1n	Transmitter Inverted Data Output
38		GND	Ground ^[1]

Notes:

- [1] GND is the symbol for signal and supply (power) common for QSFP modules. All are common within the QSFP module and all module voltages are referenced to this potential unless otherwise noted. Connect these directly to the host board signal common ground plane.
- [2] VccRx, VccI and VccTx are the receiving and transmission power suppliers and shall be applied concurrently. Recommended host board power supply filtering is shown below. Vcc Rx, VccI and Vcc Tx may be internally connected within the QSFP transceiver module in any combination. The connector pins are each rated for a maximum current of 500mA.

9. Outline Dimensions



10. Ordering information

Part Number	Description
QSFP 40G LR4 10km LC	40GBASE-LR4 QSFP, 4 CWDM lanes, 1271~1331nm SMF 10km

11. ESD

This transceiver is specified as ESD threshold 2kV for all electrical input pins, tested per MIL-STD-883, Method 3015.4 /JESD22-A114-A (HBM). However, normal ESD precautions are still required during the handling of this module. This transceiver is shipped in ESD protective packaging. It should be removed from the packaging and handled only in an ESD protected environment.